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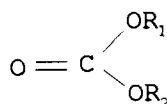
Remarks:

A request for correction of the description and claim 5 has been filed pursuant to Rule 88 EPC. A decision on the request will be taken during the proceedings before the Examining Division (Guidelines for Examination in the EPO, A-V, 3.).

(54) **Light-sensitive silver halide photographic materials and process for incorporating hydrophobic photographic additives into hydrophilic colloid compositions**

(57) Carbonic acid bis-alkyl esters are water-immiscible high-boiling organic solvents useful for dispersing hydrophobic photographic additives in hydrophilic colloid compositions which are incorporated into light-sensitive silver halide photographic materials.

In particular, said carbonic acid bis-alkyl ester compounds correspond to the general formula:



wherein R₁ and R₂, the same or different, each represents an alkyl group having 1 to 10 carbon atoms, including straight and branched chain alkyl group.

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Description

FIELD OF THE INVENTION

5 [0001] The present invention relates to light-sensitive silver halide photographic materials wherein, hydrophobic photographic additives are dispersed into hydrophilic colloid component layers with the aid of water-immiscible high boiling organic solvents.

BACKGROUND OF THE ART

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[0002] Light-sensitive silver halide photographic materials typically contain hydrophilic colloid component layers which include various photographic additives. The photographic additives are generally incorporated in the hydrophilic colloid compositions for forming the component layers by dissolving them in water or in water-miscible organic solvents and adding the resulting solution to the colloid compositions.

15 [0003] However, many photographic additives are difficult to dissolve in water and, even when soluble in water-miscible organic solvents, they can be incompatible with hydrophilic colloid compositions when incorporated therein through organic solvents. This is the case of many photographic additives which are rendered non diffusible within the photographic layers by including a long hydrophobic carbon atom chain (i.e., "ballasting chain") in their structure. Hydrophobic (ballasted) photographic additives include, for example, dye-forming couplers, DIR-compounds, UV absorbers, antioxidants, image stabilizers, etc.

20 [0004] Typically, the process of incorporating the hydrophobic photographic additives into hydrophilic colloid layers of photographic materials, such as silver halide emulsion layers, protective layers, intermediate layers and the like, consists of incorporating the photographic additives into hydrophilic colloid compositions for the layers. The photographic additives are incorporated in the form of a dispersion of fine droplets consisting of a water-immiscible high boiling organic solvent in which the hydrophobic additives have been dissolved.

25 [0005] According to the dispersion technique, as described for example in US 2,322,027, the hydrophobic photographic additives are generally dissolved in water-immiscible high boiling organic solvents (i.e., permanent solvents, crystalloid solvents, oil-type solvents, oil-formers and the like) and the resulting organic solution is added to an aqueous composition containing a hydrophilic colloid (gelatin) and a dispersing agent (surfactant). The mixture is then passed through a homogenizing apparatus (colloidal mill) to form a dispersion of fine droplets of the permanent organic solvent comprising the hydrophobic photographic additives. In some cases, it may be advantageous to facilitate the dissolution of the additives by use of an auxiliary water-immiscible low boiling organic solvent, which is removed afterwards by evaporation, as described e.g. in US. 2,801,170; 2,801,171 ; 2,835,579 and 2,949,360. The resultant dispersion is then mixed with the hydrophilic colloid composition (gelatin silver halide emulsion or other gelatin-containing composition) which is used to form the photographic layer.

30 [0006] Processes and organic solvents for dispersing photographic additives are well known in the art, as disclosed for example in US 2,322,027; 2,801,171; 2,835,579; 2,533,514; 3,554,755; 3,748,141; 3,779,765; 4,353,979; 4,430,421 and 4,430,422.

35 [0007] Organic solvents for dispersing hydrophobic photographic additives are required to meet several needs. They must (a) possess an excellent dissolving power towards the additives, (b) do not cause crystallization of the additives, (c) keep the fine droplets stably dispersed, (d) have a refractive index which is as close as possible to that of the hydrophilic colloid into which they are dispersed, and (e) not deteriorate the physical properties of the layers into which they are incorporated. Moreover, the organic solvents must not negatively affect the photographic properties of the photographic materials into which they are used to disperse photographic additives. For example, they must not give rise to fogging of the light-sensitive silver halide emulsions, and not negatively affect the stability during storage of dye-forming couplers (dispersed with the organic solvents) and of the dyes formed from the couplers during processing (stability to heat, humidity and light).

40 [0008] Accordingly, there is a continuous need for providing improved water-immiscible high boiling organic solvents for use in photography to disperse hydrophobic additives and for providing improved techniques for incorporating the additives into photographic layers.

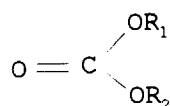
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SUMMARY OF THE INVENTION

55 [0009] The present invention provides a light-sensitive silver halide photographic material comprising a support having coated thereon a hydrophilic colloid layer which comprises hydrophobic photographic additives dispersed in fine droplets of one or more water-immiscible high boiling organic solvents, wherein at least one of said solvents is a carbonic acid bis-alkyl ester compound.

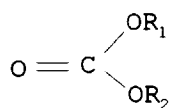
[0010] In a preferred embodiment, the carbonic acid bis-alkyl ester compounds is represented by the following gen-

eral formula:



wherein R_1 and R_2 , the same or different, each represents an alkyl group having 1 to 10 carbon atoms, including straight or branched chain alkyl groups.

[0011] In another embodiment of the present invention, a process is provided for incorporating a hydrophobic photographic additive into a hydrophilic colloid composition for forming a photographic layer, which comprises dissolving said hydrophobic additive in one or more water-immiscible high boiling organic solvents and dispersing the resulting solution in said hydrophilic colloid composition, wherein at least one of said organic solvent is a carbonic acid bis-alkyl ester compound corresponding to the general structural formula

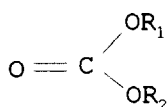


wherein R_1 and R_2 , the same or different, each represents an alkyl group having 1 to 10 carbon atoms.

DETAILED DESCRIPTION OF THE INVENTION

[0012] The color photographic films described herein have improved sensitometric performances, are able to give a sharper absorption in the three primary regions (blue, green and red) of the visible spectrum in comparison with the dispersions obtained from water-immiscible high boiling organic solvents known in the art, and have a good stability in any aging conditions. The light-sensitive silver halide photographic material comprises a support having coated thereon at least one hydrophilic colloid layer containing hydrophobic photographic additives dispersed in fine droplets of one or more water-immiscible high boiling organic solvents, wherein at least one of said solvents is an acid carbonic bis-alkyl ester compound.

[0013] Particularly useful acid carbonic bis-alkyl ester compounds are represented by the general structural formula



wherein R_1 and R_2 , equal or different, each represents an alkyl group having 1 to 10 carbon atoms, including straight or branched chain alkyl groups. The alkyl groups can be substituted with one or more substituents such as alkoxy groups, halogen atoms, nitro groups and cyano groups.

[0014] Suitable organic solvents for dispersing hydrophobic photographic additives are liquid or pasty solid compounds at room temperature, having a solubility in water of at most 1% by weight at 20°C and a boiling point higher than 90°C.

[0015] Representative examples of suitable water-immiscible high boiling organic solvents include:

1. carbonic acid bis-(2-chloroethyl) ester	$\text{OC}(\text{OCH}_2\text{CH}_2\text{Cl})_2$
2. carbonic acid bis-(3-chloropropyl) ester	$\text{OC}(\text{OCH}_2\text{CH}_2\text{CH}_2\text{Cl})_2$
3. carbonic acid bis-(2-ethoxyethyl) ester	$\text{OC}(\text{OCH}_2\text{CH}_2\text{OC}_2\text{H}_5)_2$
4. carbonic acid bis-(2-methoxyethyl) ester	$\text{OC}(\text{OCH}_2\text{CH}_2\text{OCH}_3)_2$

(continued)

5. carbonic acid bis-(3-methylbutyl) ester	$\text{OC}[\text{OCH}_2\text{CH}_2\text{CH}(\text{CH}_3)_2]_2$
6. carbonic acid bis-(n-butyl) ester	$\text{OC}[\text{O}-(\text{n-C}_4\text{H}_9)]_2$
7. carbonic acid bis-(tert-butyl) ester	$\text{OC}[\text{O}-(\text{t-C}_4\text{H}_9)]_2$
8. carbonic acid bis-ethyl ester	$\text{OC}(\text{OCH}_2\text{CH}_3)_2$
9. carbonic acid bis-(iso-propyl) ester	$\text{OC}[\text{O}-(\text{i-C}_3\text{H}_7)]_2$
10. carbonic acid bis-(n-propyl) ester	$\text{OC}[\text{O}-(\text{n-C}_3\text{H}_7)]_2$
11. carbonic acid bis-(iso-butyl) ester	$\text{OC}[\text{O}-(\text{i-C}_4\text{H}_9)]_2$
12. carbonic acid bis-(isooctyl) ester	$\text{OC}[\text{O}-(\text{n-C}_8\text{H}_{17})]_2$
13. carbonic acid bis-monoethyl mono-2-butoxyethyl ester	$\text{C}_2\text{H}_5\text{OCOCH}_2\text{CH}_2\text{OC}_4\text{H}_9$
14. carbonic acid bis-methyl ester	$\text{OC}(\text{OCH}_3)_2$

[0016] The water-immiscible high boiling organic solvents may be synthesized according to procedures well known in the art of organic chemistry for synthesizing carbonic acid esters, or in according to the following preparation methods:

- Carbonic acid ester preparation by catalytic reaction of carbon monoxide, alcohol and/or formic acid ester and urea or N-substituted urea as described in JP 59130239.
- Carbonic acid ester preparation by reacting ester of nitrous acid with carbon monoxide in liquid phase in presence of platinum metals or their salts as catalyst as described in JP 56164145..
- Carbonic acid ester production by reacting carbamate ester with alcohol as described in EP 41622.
- Carbonic acid ester production from metal carbonate by reaction with halogenated aliphatic hydrocarbon using organic tin compound as catalyst as described in JP 55038327.

[0017] The present invention also relates to a process for incorporating a hydrophobic photographic additive into a hydrophilic colloid composition used to form the colloid layer of a silver halide photographic material, the process comprising the solution of the photographic additive in one or more water-immiscible high boiling organic solvents and the dispersion of the resulting solution in the colloid composition, wherein at least one of said organic solvents is an acid carbonic bis-alkyl ester as described above.

[0018] In the process of dispersing photographic additives by using organic solvents according to the present invention, different procedures may be satisfactory followed. According to one procedure, the hydrophobic photographic additive to be dispersed is dissolved in the water-immiscible high boiling organic solvent of the present invention. The obtained solution is then added to an aqueous solution of a hydrophilic colloid binder (such as gelatin) and the mixture is emulsified by means of dispersing apparatus (such as a colloidal mill, a homogenizer and the like) in the presence of a dispersing agent (generally a surface active agent, such as an anionic surfactant, a nonionic surfactant, a cationic surfactant or a mixture thereof), said dispersing agent being preferably contained in the hydrophilic colloid binder solution. The obtained dispersion is then added to a gelatin silver halide emulsion or an aqueous solution of a hydrophilic colloid which is used for forming light-sensitive image forming layers or light-insensitive auxiliary layers of silver halide photographic materials. Alternatively, it may be advantageous to incorporate the solution of the photographic additive in the organic solvent directly into the coating composition used for forming the component photographic layer and dispersing the mixture. It is also possible to use the organic solvents in combination with other known water-immiscible high boiling organic solvents, even if the advantages set forth in the present invention can be attained using the present organic solvents alone. High boiling organic solvents which can be used in combination with the present organic solvents are, for example, phthalic acid alkyl esters, phosphoric acid esters, citric acid esters, benzoic acid esters, fatty acid esters and the like such as described in US 4,430,421. If desired or necessary, the present high boiling organic solvents and, if present, the known high boiling organic solvents can be used in combination with auxiliary low boiling organic solvents such as those not or almost not soluble in water and having a boiling point of at most 80°C, such as ethyl acetate, carbon tetrachloride, methyl ethyl ketone, etc., or water soluble organic solvents such as methanol, ethanol, tetrahydrofuran, acetone, etc. Auxiliary low boiling organic solvents are for example described in US 2,801,170, 2,801,171, 2,949,360 and 2,835,579.

[0019] The amounts of high boiling solvents for dispersing hydrophobic additives can vary according to the used additive. It is, however, undesirable to use large amounts of such solvents, because large excess of solvents may somehow deteriorate the physical properties of the photographic layers. Accordingly, it is normal practice to use the high boiling

solvents in a weight ratio to each additive in the range from 0.1 to 8.0, preferably in the range from 0.3 to 3.0.

[0020] According to this invention it is possible to improve the stability of hydrophobic photographic additive dispersions. Dye-forming couplers, UV absorbers and other hydrophobic photographic additives can be dispersed into light-sensitive silver halide photographic materials without causing unevenness of the coating or deterioration of image quality. The present invention is particularly advantageous in light-sensitive silver halide color photographic materials wherein excellent stability to light, heat and/or humidity can be imparted to the dye images obtained upon exposure and development of said materials.

[0021] Gelatin is the preferred hydrophilic colloid. However, other water-soluble colloidal substances or mixture thereof can also be used. Exemplary hydrophilic colloidal substances include gelatin derivatives, such as phthalated gelatin and acetylated gelatin, cellulose derivatives, such as carboxymethyl cellulose, starch, casein, zein, synthetic hydrophilic colloids such as polyvinyl alcohol, polyvinyl pyrrolidone, anionic polyurethanes, copolymers of acrylic acid esters, acrylonitrile and acrylamides, etc.

[0022] The hydrophobic photographic additives, which are dispersed with the aid of the water-immiscible organic solvents according to the present invention, are those which, when incorporated into the constituent layers of silver halide photographic materials, are required not to substantially diffuse within the layers themselves. A group bearing a ballasting substituent such as a hydrophobic residue with from 8 to 30 carbon atoms is introduced into the photographic additive molecule in order to avoid such diffusing process. Said substituent is called a "ballasting chain" and is linked, directly or through one or more of imino, ether, carbonamido, sulfonamido, ureido, ester, imido, carbamoyl, sulfamoyl, phenylene, etc., groups, to the photographic additive molecule. Suitable examples of ballasting chains are illustrated in US 4,009,083, in EP 73,146, 84,100, 87,930 and 87,931, in DE 3,300,412 and 3,315,012 and in JP 58-033248, 58-033250, 58-031334 and 58-106539. Preferably, such ballasting chains comprise alkyl groups, the total carbon atoms of which is no more than 20. Usually, said photographic additives have a solubility in water of at most 3% by weight at 20°C. Specifically preferred hydrophobic photographic additives include dye-forming couplers, development-inhibitor-releasing (DIR) couplers, silver halide developers, oxidized developer scavengers, spectral sensitizers and desensitizers, diffusion transfer dye image-formers, visible and ultraviolet light absorbers, which are conventionally introduced in hydrophilic colloid layers of photographic elements dispersed in water-immiscible high boiling solvents. Other hydrophobic photographic additives include those used in silver halide photographic elements such as optical brighteners, anti-oxidants, silver halide solvents, bleachable dyes and the like. Hydrophobic photographic additives for use in the present invention are described in more details in Research Disclosure 15930, July 1977.

[0023] Suitable silver halide emulsions can be any of the silver halide emulsions known in the art such as silver chloride, silver bromide, silver bromo-chloride, silver chloro-iodide, silver bromo-iodide, silver chloro-bromo-iodide emulsions and mixtures thereof. The emulsions can be composed of coarse, medium and fine grains and can be monodispersed or polydispersed. The silver halide grains may be those having a regular crystal form, such as a cube or an octahedron, or those having an irregular crystal form, such as spherical or tabular, etc., or may be those having a composite crystal form. They may be composed of a mixture of grains having different crystal forms. Their size can be varied on a wide range, but in general average grain sizes from 0.1 to 4 μm are suitable.

[0024] The silver halide emulsions may be obtained according to any of the known acid, neutral and ammoniacal method using conventional precipitation methods such as a single or twin jet method. Further, the silver halide emulsions may be chemically sensitized with a sulfur sensitizer, such as allylthiocarbamide, thiourea, cystine, etc.; an active or inert selenium sensitizer; a reducing sensitizer such as stannous salt, a polyamine, etc.; a noble metal sensitizer, such as gold sensitizer, more specifically potassium aurithiocyanate, potassium chloroaurate, etc.; or a sensitizer of a water soluble salt such as for instance of ruthenium, rhodium, iridium and the like, more specifically, ammonium chloropalladate, potassium chloroplatinate and sodium chloropalladate, etc.; each being employed either alone or in a suitable combination.

[0025] Furthermore, the above silver halide emulsions may contain various known additives for photography. For example, there may be employed additives for photography as disclosed in Research Disclosure, Item 17643, December 1978.

[0026] Moreover, the silver halides may be optically sensitized to a desired region of the visible spectrum. The method for spectral sensitization is not particularly limited. For example, optical sensitization may be possible by using an optical sensitizer, including a cyanine dye, a merocyanine dye, complex cyanine and mero-cyanine dyes, oxonol dyes, hemioxonol dyes, styryl dyes and streptocyanine dyes, either alone or in combination. Particularly useful optical sensitizers are the dyes of the benzoxazole-, benzimidazole- and benzothiazole-carbocyanine type.

[0027] The above emulsions may also contain various additives conveniently used depending upon their purpose. These additives include, for example, stabilizers or antifoggants such as azaindenes, triazoles, tetrazoles, imidazolium salts, polyhydroxy compounds and others; film hardeners such as of the aldehyde, aziridine, isoxazole, vinylsulfone, acryloyl, triazine type, etc.; developing promoters such as benzyl alcohol, polyoxyethylene type compounds, etc.; image stabilizers such as compounds of the chromane, cumarane, bisphenol type, etc.; and lubricants such as wax, higher fatty acids glycerides, higher alcohol esters of higher fatty acids, etc. Also, coating aids, modifiers of the permeability in

the processing liquids, defoaming agents, antistatic agents and matting agents may be used. As hydrophilic colloids to be used in the emulsion according to the present invention, not only gelatin but also gelatin derivatives, polymer grafts of gelatin, synthetic hydrophilic macromolecular substances and natural hydrophilic macromolecular substances other than gelatin may also be available either singly or in a mixture. Also, synthetic latexes may be added to gelatin to improve the film properties such as copolymers of acrylic acid esters, vinyl esters, etc. with other monomers having ethylenic groups.

[0028] As the support for the light-sensitive element, there may be used, for example, baryta paper, polyethylene-coated paper, polypropylene synthetic paper, cellulose acetate, polystyrene, a polyester film such as polyethylene-terephthalate, etc. These supports may be chosen depending upon the purpose of use of the light-sensitive silver halide photographic material. The supports may be provided with a subbing layer, if necessary.

[0029] The photographic emulsions can be used for black-and-white light-sensitive negative elements, light-sensitive positive elements, X-Ray elements, lithographic elements, black-and-white and color light-sensitive elements for diffusion transfer processes and light-sensitive elements which contain oil-soluble or water-soluble color couplers.

[0030] Preferably, the silver halide emulsions are designed for multicolor elements comprising dye image forming units sensitive to each of the three primary regions (blue, green and red) of the visible spectrum. Each unit can be formed by a single emulsion layer or multiple emulsion layers sensitive to the same spectral region.

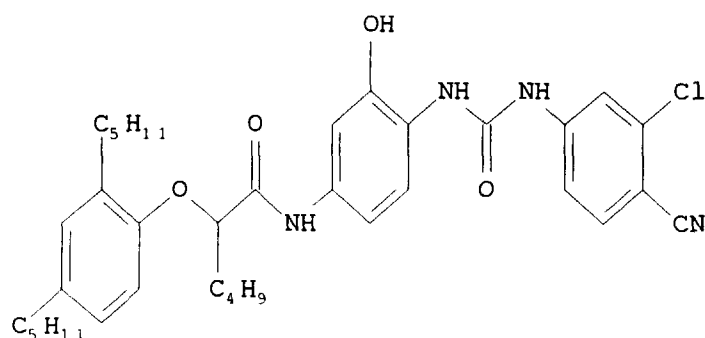
[0031] More preferably, the silver halide emulsions are designed for a multicolor element comprising a support bearing at least one blue-sensitive silver halide emulsion layer and preferably two blue-sensitive silver halide emulsion layers of different sensitivity associated to yellow dye forming couplers, at least one green sensitive silver halide emulsion layer and preferably at least two green-sensitive silver halide emulsion layers of different sensitivity associated to magenta dye forming couplers, at least one red-sensitive silver halide emulsion layer and preferably at least two red-sensitive silver halide emulsion layers of different sensitivity associated to cyan dye forming couplers, and additional non light-sensitive hydrophilic colloid layers (such as protective layers, intermediate layers, filter layers, subbing layers, backing layers and the like), wherein at least one component layer of said material comprises incorporated therein a hydrophilic photographic additive dispersed with the aid of a water-immiscible high boiling organic solvent according to the present invention, said component layers comprising preferably at least one silver halide emulsion layer including a dye forming coupler.

[0032] The following examples further illustrate the invention.

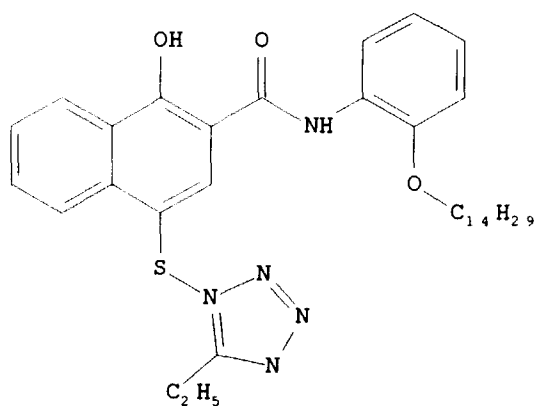
EXAMPLE 1

[0033] As hydrophobic photographic additives were used two cyan couplers C1 and C2 of formula:

C1



C2



[0034] A solution was obtained by dissolving 6.80 g of coupler C1 and 0.40 g of coupler C2 in a mixture of high boiling organic solvents and ethyl acetate as an auxiliary solvent in the amounts reported in the following Table 1 at 60 °C. The obtained solutions were incorporated in a 10% (w/w) gelatin solution containing a 5% (w/w) Hostapur solution and the composition stirred with a rotary mixer at 10.000 r.m.p. and added with water during stirring. The final composition of the five obtained dispersions D1 to D5 is reported below in Table 1, expressed in g x 100 g of final dispersion:

TABLE 1

	D1	D2	D3	D4	D5
C1	6.8	6.8	6.8	6.8	6.8
C2	0.4	0.4	0.4	0.4	0.4
TPP		11.76			11.76
TCP	11.76				
DBP			11.76		5.04
DOC				11.76	
BAA	5.04	5.04	5.04	5.04	
Ethyl Acetate	12.00	12.00	12.00	12.00	12.00
Gelatin	5.32	5.32	5.32	5.32	5.32

TABLE 1 (continued)

	D1	D2	D3	D4	D5
Hostapur™	0.60	0.60	0.60	0.60	0.60
Water	up to 100g	up to 100g	up to 100g	up to 100g	up to 100g

[0035] In Table 1, TPP is tris-phenylphosphate, TCP is tris-cresylphosphate, DBP is di-butylphthalate, DOC is carbonic acid bis-(iso-octyl) ester (compound 12 according to this invention), BAA is N-butylacetanilide, and Hostapur™ is a sec-alkane sulfonate, sodium salt, surfactant sold by Hoechst AG. Dispersion D5 represents the reference dispersion used by the Applicant in multilayer color photographic films on the market.

[0036] To 600 g of each of the above coupler dispersions were added 1000 g of high speed red sensitized AgBrI emulsion (having 12% AgI mole and 1.10 μm average grain diameter, chemically ripened with gold and thiosulfate, 112 g of gelatin dissolved in 1500 g of water and hydroquinone potassium monosulphonate as antifoggant.

[0037] The resulting coating formulations were coated at a silver coverage of 2,00 g/m^2 on a cellulose triacetate support base, together with a protective layer coated at a gelatin coverage of 1,2 g/m^2 and 142 mg/m^2 of a carbamoyl pyridinium hardener to obtain five photographic films, F1 to F5.

[0038] Samples of each film were exposed to a light source having a color temperature of 5.500 Kelvin through an optical step wedge and developed in a standard type C41 process as described in British Journal of Photography, July 12, 1974, pp.597-598.

[0039] The following Table 2 reports sensitometric results obtained by exposing and processing films F1 to F5.

TABLE 2

Film	Dmin	Dmax	Speed 0.2	Speed 1.0	Contrast 1	Contrast 2
F1 (comp.)	0.13	1.50	2.35	1.29	0.72	0.56
F2 (comp.)	0.13	1.81	2.39	1.60	0.90	0.70
F3 (comp.)	0.14	1.92	2.40	1.66	0.96	0.75
F4 (inv.)	0.15	1.90	2.44	1.74	1.00	0.75
F5 (ref.)	0.14	1.97	2.42	1.68	0.98	0.77

[0040] Film F4, prepared with the dispersion using DOC, resulted in higher sensitivity in comparison with the films using other dispersing oils.

[0041] The effect of the high boiling organic solvents on the sharpness of absorption of dyes obtained from the couplers upon exposure and color development was evaluated at Dmax over a developed sample of each film. The resulting spectrophotometric curve of the film prepared with the dispersion using DOC shows a reduction of the band width in the short wavelength side similar to that one of film prepared with the dispersion using DBP in the short wavelength region. This represents an improvement in color reproduction, because of the reduced overlapping with the absorption band of magenta dyes in multilayer color photographic films. Additionally, the spectrophotometric curve of the film prepared with the dispersion using DOC shows in the long wavelength side a sharper absorption not present in the other films. This represents an improvement in the printing process of the developed color photographic film contained a negative image to obtain the final positive print on a color photographic paper, as the differences between the cyan dye absorption in the negative and the spectral sensitization of the paper to the red light (modulated by the cyan layer in the negative) are reduced.

[0042] The sensitometric stability was evaluated by three accelerated aging tests:

Test A = film samples conditioned at 85% RH and 21°C for 24 hours, then sealed in a plastic bag and stored for three days at 50°C, then reconditioned to 50% RH and 21°C, exposed and processed.

Test B = film samples stored for seven days at 50% RH and 50°C, then reconditioned to 50% RH and 21°C, exposed and processed.

Test C = film samples stored for seven days at 75% RH and 38°C, then reconditioned to 50% RH and 21°C, exposed and processed.

[0043] In the tables 3 and 4 below are reported the variations of the main sensitometric parameters in comparison with film samples kept in shelf conditions (50% RH and 21 °C), processed and evaluated together with the aged sam-

ples.

TABLE 3

Film	AGING TEST A		AGING TEST B			
	Delta Dmin	Delta Dmax	Delta Dmin	Delta Dmax	Delta Speed 0.2	Delta Speed 1.0
F1	0.08	0.12	-0.01	-0.04	0.03	-0.01
F2	0.07	-0.10	-0.02	-0.03	0.02	0.02
F3	0.07	-0.20	-0.01	-0.02	0.04	0.02
F4	0.06	0.00	-0.01	-0.01	0.04	0.03
F5	0.06	-0.10	0.00	0.01	0.04	0.05

TABLE 4

AGING TEST C				
Film	Delta Dmin	Delta Dmax	Delta Speed 0.2	Delta Speed 1.0
F1	0.02	0.07	0.01	0.07
F2	0.00	-0.01	0.01	0.02
F3	0.02	0.02	0.04	0.01
F4	0.01	-0.02	0.01	0.01
F5	0.03	-0.03	-0.01	0.04

[0044] Films prepared using the photographic color coupler dispersed in a high boiling solvent mixture containing DOC are characterized to a good stability in any aging condition, equal or better than that of films prepared using other solvent mixtures.

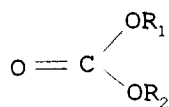
EXAMPLE 2

[0045] Five photographic films, F6 to F10, were produced following the procedure of Example 1. Film F6 was similar to film F5, Film F7 was similar to film F4, film F8 was similar to film F5, film F9 was similar to film F4 but carbonic acid bis-(n-butyl) ester (compound 6 according to this invention) was used instead of carbonic acid bis-(n-octyl) ester in the same amount, film F10 was similar to film F4 but carbonic acid bis-methyl ester (compound 14 according to this invention) was used instead of carbonic acid bis-(n-octyl) ester in the same amount.

[0046] Samples of films F6 to F11 were exposed and processed as described in Example 1. The results confirmed the reduction of the band width in the short and in the long wavelength side of the spectrophotometric curve with the organic solvents according to this invention.

Claims

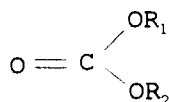
1. A light-sensitive silver halide photographic material comprising a support and a hydrophilic colloid layer coated thereon, said hydrophilic colloid layer comprising hydrophobic photographic additives dispersed in fine droplets of one or more water-immiscible high boiling organic solvents, wherein at least one of said solvents is a carbonic acid bis-alkyl ester compound.
2. The light-sensitive silver halide photographic material of claim 1, wherein said acid carbonic bis-alkyl ester compound is represented by the general structural formula



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10 wherein R_1 and R_2 , equal or different, each represents an alkyl group having 1 to 10 carbon atoms.

3. The light-sensitive silver halide photographic material of claim 1, wherein said hydrophobic photographic additive is a dye-forming coupler.
- 15 4. The light-sensitive silver halide photographic material of claim 1, wherein said hydrophilic colloid layer is a gelatin silver halide emulsion layer.
5. The light-sensitive silver halide photographic material of claim 1, wherein said boiling organic solvents, wherein said carbonic acid bis-amyl ester is carbonic acid di-octyl ester.
- 20 6. A process for incorporating a hydrophobic photographic additive into a hydrophilic colloid composition for forming a photographic layer, which comprises dissolving said hydrophobic additive in one or more water-immiscible high boiling organic solvents and dispersing the resulting solution in said hydrophilic colloid composition, wherein at least one of said organic solvent is a carbonic acid bis-alkyl ester compound corresponding to the general structural formula
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35 wherein R_1 and R_2 , the same or different, each represents an alkyl group having 1 to 10 carbon atoms.

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7. The process of claim 6 wherein said hydrophobic photographic additive is a dye-forming coupler.
8. The process of claim 6 wherein said hydrophilic colloid layer is a gelatin silver halide emulsion layer.
- 40 9. The process of claim 6 wherein said hydrophobic additive is dissolved in said water-immiscible high boiling organic solvents in the presence of a low boiling auxiliary organic solvent.

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EUROPEAN SEARCH REPORT

Application Number
EP 98 10 0802

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Place of search MUNICH		Date of completion of the search 11 May 1998	Examiner Lindner, T
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Place of search MUNICH		Date of completion of the search 11 May 1998	Examiner Lindner, T
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